

The Use of Laser In Canine Rehab



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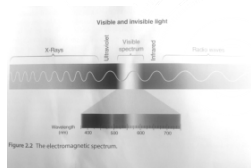
LASER THERAPY



- LASER: *Light Amplification by Stimulated Emission of Radiation*
 - The use of light energy to affect underlying tissues
- PHYSICS
 - A photon directed at an atom causes an absorption of energy. This excites the atom molecule, causing electrons to jump from inner orbit to outer orbits. Then when the atom falls back again it gives off energy again.
 - So energy is passed along beyond the directly stimulated tissues

LASER THERAPY

- Attributes of LASER
 - Coherence (same wavelength)
 - Monochromicity (color of light – wavelength)
 - Collimating (parallel beams / no divergence)
 - 600nm – 1000nm is the therapeutic window
 - Chromophores within tissue absorb these wavelengths
 - 800nm – 1100nm (Near I.R.) penetrate the deepest
 - Attenuation (loss of power) occurs more in darker skins & areas of more superficial circulation
 - Dark hair & dark skin absorb more laser light
 - Hemoglobin in the blood absorbs laser energy
 - Absorption is hindered in older more dehydrated skin



LASER THERAPY

- Classes of Laser



Class 1 / 1M (<0.5 mW) •Visible & Non-visible •No eye or skin danger •Some pointers, car entry and remotes •Grocery store scanners •No heating & No healing	Class 2 / 2M (< 1mW) •Visible •Safe for short periods of time on eyes and for extended periods of time on the skin •Some pointers •Grocery store scanners •Some measuring devices
Class 3 (1mW – 500mW) 3A (3R) <5mW •Visible & Invisible •Pointer lasers 3B >5mW lasers •Visible & Invisible •Hazardous to eye (with direct viewing or 'mirror viewing' •Minimal hazard to skin (<1 degree C.)	Class 4 (> 500mW) 4a (Therapeutic lasers) / 4b (Surgical) •Increases tissue temperature •Hazardous to eye (direct, indirect, diffuse or scattered reflection) •Fire Hazard (may ignite combustible material)

The Use of Lasers in Canine Rehab

LASER THERAPY



- Terminology
 - LLLT – Low Level Laser Therapy (Class 3B)
 - Cold Laser
 - HPLT – High Powered Laser Therapy (Class 4a)
 - Laser Therapy
 - Photobiomodulation (power-neutral term)

LASER THERAPY



- Modes of Emission
 - Continuous Wave
 - Pulsed (Gate-Pulsed): emits in an on/off cycle.
 - Pulsing does not affect depth of penetration
 - Pulsing affects power &/or time to achieve desired Joules
 - Allows for heat dissipation. Know & report duty cycle to be able to calculate actual Joules delivered.
 - Super-pulsed: extremely short bursts of light using a high wattage / power, followed by an interval of nothing before the next pulse.
 - Flash of light lasts for nanoseconds
 - Average power of a series of super-pulses is low
 - Cumulative Joules or J/cm² is low
 - Typically 904nm / 905nm wavelength
 - Penetration increases during exposure time

LASER THERAPY

- Application Techniques
 1. Treat the target tissue & surrounding tissues
 - Laser has no effect on normal, healthy tissues
 2. Point contact
 - Less energy loss b/c of less reflection from both hair and skin
 - Less energy absorption by superficial structures
 - Compression blanches the tissues & reduces incidental absorption by chromophores in the blood – Hb is the main light absorber in blood
 3. Keep the hand piece perpendicular to the skin
 4. On joints, laser with the joint in varying degrees of ROM
 5. Treat 360° around the joint & bordering tissues

LASER THERAPY

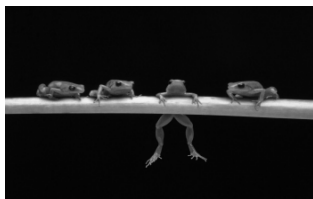
- Application Techniques
 1. Scanning Mode (vs point contact)
 - Needed for Class 4 lasers
 - Moving at a speed of 3 – 7 cm/second
 - Use a repetitive pattern in a grid formation
 - Parallel to the skin / surface
 - Use a finger at the dermis / hair to check skin & hair temperature
 - Treat areas adjacent to the target tissues.

The Use of Lasers in Canine Rehab

LASER THERAPY

- Effects & Indications of Laser

HOLD ONTO THAT THOUGHT!



LASER THERAPY



❖ LASER

■ CONTRAINDICATIONS

- Over the Eye
- Locally Injected medications
 - Simply wait for it to be absorbed & translocated
 - Laser induced vasodilation may alter pharmacodynamics
- Pregnancy
 - Not likely to harm
 - No research exists... to it's just a legal 'cover your behind'
- Active haemorrhaging

Godbold & Riegel. Contraindications, Special Considerations and Precautions. In Laser Therapy in Veterinary Medicine: Photobiomodulation. Wiley Blackwell, Iowa, 2017, pp 67 – 73.

LASER THERAPY



❖ LASER

■ CONTRAINDICATIONS

- Over malignancy (conflicting evidence)
 - For safety – no lasering over malignancy or margins
 - *Might* be okay if tumour has been removed and margins are clear
 - Current data says "Okay to laser at sites distant to the tumour"
 - Considered useful for pain and inflammation in terminal patients
 - Owner involvement in decision to use laser is imperative!
 - *In vitro* studies show that laser might stimulate a tumour
 - *In vivo* studies have actually shown it might be beneficial

Godbold & Riegel. Contraindications, Special Considerations and Precautions. In Laser Therapy in Veterinary Medicine: Photobiomodulation. Wiley Blackwell, Iowa, 2017, pp 67 – 73.

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❖ LASER

■ PRECAUTIONS

- Active Epiphysis / Open Fontanel
 - Rodent studies have conflicting results
 - Daily laser x 21 days, changed bone length
 - Lasering every 2nd day x 21 day, changed cartilage, but not bone length
 - Clinical uses (as you would use laser normally) is likely okay
- Over the Thyroid
 - High doses (i.e. 140J/cm²) causes thyroid changes.
 - Therapeutic doses (i.e. 4J/cm²) did not.

Godbold & Riegel. Contraindications, Special Considerations and Precautions. In Laser Therapy in Veterinary Medicine: Photobiomodulation. Wiley Blackwell, Iowa, 2017, pp 67 – 73.

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❖ LASER

■ FALSELY PROPOGATED MYTHS

- Over Testicles
 - In vitro it increased sperm motility
 - In vivo it increased spermatogenesis
 - Normal doses okay
 - Higher doses (i.e. 47J/cm2) may have a destructive effect on seminiferous epithelium
- Tattoos & Hyperpigmentation
 - Just feel for heating
- Microbial Infection
 - It actually helps
- Photosensitizing meds (A review papers found no adverse effects)

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• LASER ENERGY

- Measurement of power over time
 - Energy (Joules) = Watts (W) x Seconds
 - 1 Joule = 1 Watt X 1 Second
- 3B Lasers come in mW of power: 1000mW=1W
 - To get 1J. Of energy from a 5mW laser, you would need 200 seconds of timer per point
 - To get the same effect from a 50mW laser, you would use 20 seconds of time
 - To get the same effect from a 200mW laser, you would need 5 seconds of time
 - And with a 500mW laser, it takes 2 seconds
 - And with a 4 Watt laser it will take 0.25 seconds

LASER THERAPY



• LASER ENERGY

- Measurement of power over time
 - Energy (Joules) = Watts (W) x Seconds
 - 1 Joule = 1 Watt X 1 Second
- The glitch with Class 4a Lasers
 - To calculate joules. Using a laser scanning technique, do an area the size of a business card each time. This is 10cm2. Then you will calculate total joules delivered & divide by surface area.
 - i.e. 6 Watts x 60 seconds = 360 Joules divided by 10cm2 = 36J/cm2 (at the surface).
 - However, d/t non-contact technique the majority of light is superficially absorbed or reflected.
 - Difficult / impossible to know how much is penetrating.

LASER THERAPY



• LASER Dosage

- **TRADITIONAL**
 - For Acute Injuries: 0.05 – 2 Joules/cm2
 - For Subacute Injuries: 3 – 4 Joules/cm2
 - For Chronic Injuries: 5 – 8 Joules/cm2
 - For Bio-inhibition: 9 – 12 Joules/cm2
- ***** AT the TARGET TISSUE *****
 - Dosage time may need to be increased get the desired joules at a deeper target tissue
 - NEW recommendations are coming that take into account Class 4 lasers & Superpulsed lasers

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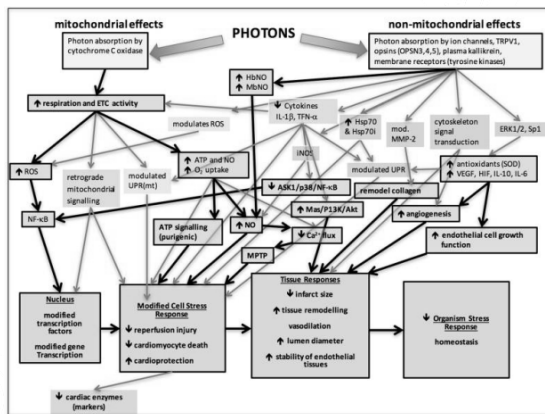
- LASER Dosage
 - VARIABLES
 - Hair thickness / coat / colour, body types, skin thickness & colour
 - Deeper target tissues will require higher superficial dosing than superficial target tissues
 - WIDE safety margins for dosing
 - Important to note that *In Vitro* dosing vs *In Vivo* dosing can vary substantially!!!
 - Anders et al 2014, stated that *In Vitro* requires 97.5% LESS than doses delivered at the skin.

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- LASER OUTCOMES
 - Pain on palpation
 - Quality of movement
 - Quantity of movement
 - Frequency of movement
 - Type of movement
 - Owner's subjective reports (mood, happiness, willingness to move, & abilities)

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- ❖ LASER for PAIN RELIEF & HEALING
 - > General effectiveness due to:
 - Anti-inflammatory mechanisms similar to pharmacological agents (celecoxib, meloxicam, diclofenac, & dexamethasone)
 - Ability to reduce oxidative stress
 - Improved angiogenesis
 - Augmentation of collagen synthesis & skeletal repair
 - Inhibition of transmission at the neuromuscular junction (reduced nerve firing)

Bjordal et al 2006; Chow et al 2009

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❖ LASER for TENDINOPATHIES

- High quality reviews & meta-analyses
 - (Tumilty et al 2010)
- TENDINOPATHY lesions:
 - Epicondylitis: positive studies used wavelength of 904nm x 3.5 J/cm² and 1064nm x 150 J/cm²
 - Rotator Cuff: 4.3 – 42 J/cm² using 904 or 820nm lasers
 - Achilles tendinopathy: 1.8 – 3.6 J/cm² x 904 or 820nm lasers
 - DeQuervains: 4 J/cm² x 830nm laser.

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❖ LASER for TENDINOPATHIES

- TENDINOPATHY lesions:
 - Stretching the Achilles causes a higher energy attenuation by the tissue.
 - Adding laser to an eccentric exercise program can bring added benefits.
 - Cryotherapy before LLLT produces superior histology and biomechanical results .

Bordvick et al 2017; Tumilty et al 2016; Haslerud et al 2017

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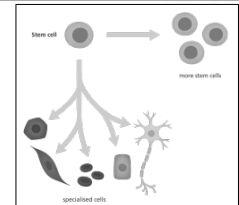


❖ LASER for TENDINOPATHIES

- TENDINOPATHY lesions: Combining LLLT & PRP for Achilles tendon injuries (in rats)
 - PRP alone or LLLT alone were better than nothing
 - PRP alone and LLLT alone + no significant differences between groups
 - PRP + LLLT = Significantly decreased healing time compared to any of the groups
 - PRP + LLLT = Higher deposition of collagen type 1.
 - PRP + LLLT at 830 nm resulted in a larger number of fibroblasts and increased concentration of type 1 collagen

Allahverdi et al 2015; Barbosa et al 2013; de Carvalho et al 2016

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❖ LASER plus Stem Cell

- While we're on it...
- Most research is In Vitro & finding that LLLT increases the proliferation rate of the irradiated cells
- In Vivo studies have found increased cell proliferation, survival time of the stem cells, differentiation of cells, angiogenesis, improved function (for combination in Spinal cord cases), bone formation (for bone healing cases) & wound healing.

Note: Protocol used by a leading USA Vet Practice in regenerative medicine (VOSM): 250mW, 5J/cm², using 600 – 900 nm probe, 1 – 2x/week for Stem Cell – PRP treatments.

Ginani et al 2015; Canapp D 2017

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❖ LASER and WOUNDS

- A review of experimental studies (rodents)
 - Acute Superficial wounds / Hot Inflammatory conditions 1 – 4 J/cm²
 - Chronic Superficial wounds / Chronic Superficial conditions 4 – 30 J/cm²
 - Acute Superficial Pain or Injury 2 – 4 J/cm²
 - Acute Deep Pain or Injury 4 - 8 J/cm²
 - Chronic Deep Pain or Injury 6 – 20 J/cm²

Peplow et al 2010

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- LASER for NECK PAIN
 - High quality reviews & meta-analyses!
 - (Chow et al 2009)
 - Acute and chronic NECK PAIN:
 - Optimum dose per point for an 820-830nm laser was **5.9 Joules** and
 - Using a 904nm super-pulsed laser, it was **2.2 Joules**.
 - Number of reps and Rx / week were variable.
 - Positive effects were immediate and could be maintained for up to 3 months after treatment ended!

LASER THERAPY



- LASER for PAIN
 - High quality reviews & meta-analyses!
 - (Bjordal et al 2006)
 - LLLT at high doses (7.5 J/cm²) at the target tissue in the first 72 hours (to reduce inflammation & pain)
 - Followed by the lower doses (2 J/cm²) at target tissues in subsequent days (to promote tissue repair)

LASER THERAPY



- LASER and OSTEOARTHRITIS
 - High quality reviews & meta-analyses!
 - Low level laser therapy significantly reduces pain and improves health status in chronic joint disorders
 - Knee doses: **2.1 – 12 Joules** (total per session)
 - Lumbar spine doses: **16 – 60 Joules** (per session)
 - TMJ doses: **0.7 – 2.1 Joules** (per session)
 - Cervical spine: **10 – 60 Joules** (per session)

Bjordal et al 2003

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- LASER and OSTEOARTHRITIS
 - Newer research studies
 - Knee OA: **Superpulsed Laser – 6J/cm² & 10 J/cm²**
 - Improvements in pain, swelling, & function
 - Knee OA: **850nm – CW – 48J/cm²**
 - Improvements in pain and function
 - Lumbar spine doses: Great variation – review & analysis
 - Two studies used ≤ 2.8 J/point, while much higher dosages were used in another two trials (239 and 1200 J/point, respectively). The remaining six trials used doses in the range of 3–25 J/point. HIGH DOSES were better.
 - TMJ doses: 3.4 J/cm(2) – helped with pain



Soleimanpour et al 2014; Alghadir et al 2014; Glazov et al 2016; Madani et al 2014

LASER THERAPY

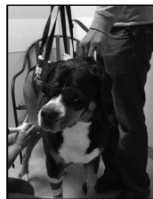
- LASER and OSTEOARTHRITIS
 - Dog Study!
 - Elbow OA
 - Regularly scheduled PBMT at 10 to 20 J/cm² per joint for 6 weeks was successful in improving lameness and pain scores, and in lowering NSAID requirement in canine elbow osteoarthritis patients.



Looney et al 2018

LASER THERAPY

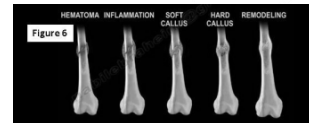
- LASER and BONE HEALING
 - Dog Studies following TPLO!
 - 1.5 – 2.25J/cm² prior to and at check ups after TPLO... “no beneficial effects on pain or function.”
 - 800-900 nm dual wavelength, 6 W, 3.5 J/cm², 100 cm² area for a single preoperative treatment improved peak vertical force 8wks post op!
 - 660 nm red (100 mW) and 800, 905 and 970 nm infrared (maximum 15 W continuous wave, 20 W peak pulsed wave) x 3 or 4 sessions perioperatively, improved gait but not bone healing.



Kennedy et al 2018; Rogatko et al 2017; Renwick et al 2018

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- LASER and BONE HEALING
 - Rabbit dental implant study – tested 5, 10, & 20J/cm² of GaAlAs laser (830nm, 50mW) applied Q48hr x 13 days. = 20J/cm² was best, 10J/cm² was second best!
 - Tibial fracture study – tested 850nm, 100 mW, 8 J/cm², 64 s x 10 days. = expedited bone repair (histologically & radiographically)
 - Femoral osteotomy study – tested 830nm, 50mW, 6J (single point) x Q48hrs x 7, 15, & 21 days = significant increase in bone formation at day 7 (but no significant differences at days 15 or 21.



Gomes et al 2015; Briteño-Vázquez et al 2015; Batista et al 2015

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• LASER and BONE HEALING

Table 1
Different protocols of LLLT

Author	Dose (J or J/cm ²)	Wavelength
AboElsaad, 2009 [17]	16 J/cm ²	830 nm
Nascimento et al., 2010 [18]	20 J/cm ²	830 nm
Pires-Oliveira et al., 2010 [19]	50 J/cm ²	904 nm
Pinheiro et al., 2010 [20]	4 J/cm ²	850 nm
Fávaro-Pípi et al., 2010 [21]	0.51 J (50 J/cm ²)	830 nm
Coelho et al., 2014 [16]	4 J/cm ²	830 nm
Batista et al., 2014 [2]	6 J (210 J/cm ²)	830 nm
Eslamian et al., 2014 [4]	2 J/cm ²	810 nm

Batista et al 2015



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• LASER and NERVES

- Laser the Spinal Cord segments corresponding to nerve and to injured nerve / reconstructed nerve.
- 10 – 30 J/cm² has been used in the literature
- However, only 2.45% of 980nm laser light will reach the peroneal N. in rabbits (Anders et al 2014)

Shamir et al 2001; Rochkind et al 2007 a, b; Rochkind et al 2001; Barbosa et al 2010; Anders et al 2014

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• LASER and SPINAL CORD INJURY

- It helps!
 - Laser: 810nm x 150mW x 1589 J/cm² daily (administering LLLT for 2997 seconds/day) x 14 days) – Byrnes & Wu studies
 - Speculated only 6% power penetration to the spinal cord
 - Laser: 780nm x 250mW x 30 min/day x 14 days
- Significantly increased axonal number and distance regrowth.
- Suppressed immune cell activation and cytokine/chemokine expression.
- Increased the length & number of axons & better functional recovery
- Return of some aspects of function to baseline levels.

Byrnes et al 2005; Wu et al 2009, Rochkind et al 2002



LASER THERAPY

• LASER and SPINAL CORD INJURY

- Dog Study! LLLT after hemilaminectomy for a thoracolumbar disc herniation
- 200mW, 810nm x 1 minute per area (5 diode cluster probe) = 12 J/cm²
- Median time to walking was 3.5 days in the LLLT group and 14 in the control group



Draper et al 2012

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- LASER and NEURAL TISSUES
 - One may assume that only 1-2% of the Joules delivered at the surface will reach deeper target tissues (i.e. Spinal cord or Peripheral Nerves)
 - Also laser the Lymph Nodes!
 - For Pain (vs biostimulation of the cord), triple your time/dose.

Byrnes et al 2005; Wu et al 2009, Rochkind et al 2002; Godine 2017

LASER THERAPY



Figure 17.2. Feline patient with CDS receiving transcranial FBMT with a 500nm, 810nm multiprobe handpiece.

- LASER and THE BRAIN
 - You can treat OCD, Cognitive Dysfunction, Cerebral Degeneration, Brain Injury, (& Cerebellar Degeneration)
 - 808nm Laser can penetrate through the scalp, skull, and meninges to a brain depth of 40 – 50cm
 - Low frequency pulsed light may be more effective
 - It has the potential to mitigate and even reverse progressive cerebral degeneration.
 - It can be used to treat brain injuries
 - Aim for 0.3 – 3.0J/cm² @ the target tissue / cortex!

Tedford et al 2015; Ando et al 2010; Godine 2007; Quihe et al 2012; Xuan et al 2013; Oron et al 2012; Naeser et al 2011

LASER THERAPY



- LASER ACUPUNCTURE
 - Has biological effects
 - Can reduce joint swelling
 - Can reduce post-operative pain
 - Can improve spasticity in CP children
 - Can alleviate oxidative stress and inflammation, improve antioxidant and energy metabolic status while suppressing disease activity in rheumatoid arthritis patients
 - Doses range from 0.48J/cm² (testing for minimum dose), 2 – 6 J/cm² (combining with massage), to
 - 80 – 200 J/point (superficial points) or 125 – 200J (deep points) with low watts and a pulsed mode of emission.
 - 4.5 - 27 J/cm² for Myofascial Trigger Points

Medina C. 2017; Yurtkuran et al 2007; Airaksinen et al 1989; Fuchtenbusch & Rosin 2006; Hsieh et al 2015

LASER THERAPY

- LASER – Dosage Calculations for Depth
 - Depth of Penetration
 - Irradiation Time [secs] = ((D x A) / P) x (1 + d)
 - D = Desired Dose at Target Tissue [Joules/cm²]
 - A = Area of Target Tissue [sq. cm]
 - P = Power of Incident Beam (Watts)
 - d = Depth of Target Tissue (cm)
 - Note: the parameter 'd' is limited to a range of 0-4cm, with values 1-4 only applicable to the deeper-penetrating wavelengths (approx. 760-860nm GaAlAs and super-pulsed 904nm GaAs).
 - So.....

Hode L & Tuner J, 2014

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• LASER – Dosage Calculations for Depth

- So, if I treat a chronic 1 cm² tendon lesion 2 cm deep, with the goal to deliver 8 J/cm², with my 500mW laser...
- ((8 x 1) / 0.5) x (1 + 2) =
- I would laser for 48 seconds per point
- (The equivalent of 24 J/cm² at the surface!!).

Laser Power Per Emitter = 500mW (2000mW Cluster Probe has 4x 500mW Emitters so Treats 4 Points)										
Tissue Depth (cm)	0	0.5	1	1.5	2	2.5	3	3.5	4	Duration (Secs)
1x 4	2.0	3.2	4.0							
1x 8	4.0	2.7	2.0	1.6	1.3	1.1	1.0			
1x 12	6.0	4.0	3.0	2.4	2.0	1.7	1.5	1.3	1.2	
1x 16	8.0	4.5	4.0	3.2	2.7	2.3	2.0	1.8	1.6	
1x 20	10.0	6.7	5.0	4.0	3.3	2.9	2.5	2.2	2.0	
1x 24	12.0	8.0	6.0	4.8	4.0	3.4	3.0	2.7	2.4	
1x 32	16.0	10.7	8.0	6.4	5.3	4.6	4.0	3.6	3.2	
1x 40	20.0	13.3	10.0	8.0	6.7	5.7	5.0	4.5	4.0	
1x 48	24.0	16.0	12.0	9.6	8.0	6.9	6.0	5.3	4.8	
1x 64	32.0	21.3	16.0	12.8	10.4	9.1	8.0	7.1	6.4	
1x 80	40.0	26.7	20.0	16.0	13.3	11.4	10.0	8.9	8.0	
1x 96	48.0	32.0	24.0	19.2	16.0	13.7	12.0	10.7	9.6	
2x 64	32.0	21.3	16.0	12.8	10.4	9.1	8.0	7.1	6.4	
2x 80	40.0	26.7	22.9	20.0	17.8	16.0	14.2	12.8	11.6	
2x 96	48.0	32.0	27.6	24.0	21.3	19.2	17.2	15.6	14.4	
3x 80	40.0	26.7	34.3	30.0	26.7	24.0	21.3	19.2	17.6	
3x 96	48.0	32.0	40.0	36.0	32.0	28.8	25.6	23.0	20.8	

Biostimulation: Tissue Repair; Wound Healing.
 Sub-Acute Inflammation; Chronic Pain.
 Acute Inflammation; Acute Pain.

- Notes:
1. First, select the Depth of the injured tissue under the skin (Blue Numbers from 0 to 4).
 2. Then, choose a Dose from within the appropriate color-coded cells.
 3. Look to the left to find the applicable Duration (Red Number), and set the Control Unit accordingly.
 4. The black numbers in the left-most column refer to the number of times you will treat the same point at the same time setting, to achieve the required dose at the target depth in the tissue.

Note: Based on a 1cm² lesion

Courtesy of SpectraVet.com

WALY Veterinary Dosage Recommendations Task Force								
Stationary Contact Application: CW & Switched/Gated CW								
CANINE 50 lb: Osteoarthritis/Degenerative Joint Disease								
PATHOLOGY / ANATOMICAL LOCATION	PROBE TYPE / ANATOMICAL LOCATION	NUMBER OF PROBE APPLICATIONS / POINTS / SITES / Note 2	DURATION PER POINT / SITE (seconds)	TOTAL TREATMENT DURATION (minutes)	TOTAL AVERAGE POWER (Watts)	TOTAL ENERGY (Joules)	SURFACE IRRADIANCE (W/cm ²)	FLUENCE AT TARGET POINT/SITE (Joules/cm ²)
Manus/Pes	Single	3-5	20-30	1:30-1:40	0.05-0.25	5.0-25.5	0.05-0.25	3.5-5.0
	Multi	1-2	20-30	0:30-1:40	0.25-1.25	10.0-37.5	0.05-0.25	1.5-5.0
	Cluster	1-2	40-90	1:20-1:30	0:10-0:75	9.0-60.0	0.05-0:10	4.0-4.5
Carpus/Tarsus	Single	3-5	20-30	1:30-1:40	0.05-0.25	5.0-22.5	0.05-0.25	1.5-5.0
	Multi	1-2	20-30	0:30-1:40	0.25-1.25	10.0-37.5	0.05-0.25	1.5-5.0
	Cluster	1-2	40-90	1:20-1:30	0:10-0:75	9.0-60.0	0.05-0:10	4.0-4.5
Elbow	Single	8-12	20-30	4:00-4:20	0.05-0.25	24.0-60.0	0.10-0:25	3.0-5.0
	Multi	2-3	20-30	1:00-1:20	0.25-1.25	30.0-75.0	0.10-0:25	3.0-5.0
	Cluster	3-4	40-90	2:40-4:30	0:10-0:35	27.0-120.0	0.05-0:10	4.0-4.5
Shoulder	Single	8-12	20-30	4:00-4:20	0.05-0.25	24.0-60.0	0.10-0:25	3.0-5.0
	Multi	2-3	20-30	1:00-1:20	0.25-1.25	30.0-75.0	0.10-0:25	3.0-5.0
	Cluster	1-4	40-90	2:40-4:30	0:10-0:35	27.0-120.0	0.05-0:10	4.0-4.5
Stifle	Single	12-16	20-30	5:20-6:00	0.05-0.25	36.0-80.0	0.10-0:25	3.0-5.0
	Multi	3-4	20-30	1:20-1:30	0.25-1.25	45.0-120.0	0.10-0:25	3.0-5.0
	Cluster	3-4	40-90	2:40-4:30	0:10-0:35	27.0-120.0	0.05-0:10	4.0-4.5
Hip	Single	12-16	20-30	5:20-6:00	0.05-0.25	36.0-80.0	0.20-0:50	6.0-10.0
	Multi	3-4	20-30	1:20-1:30	0.25-1.25	45.0-120.0	0.20-0:50	6.0-10.0
	Cluster	3-4	40-90	2:40-4:30	0:10-0:35	54.0-120.0	0.10-0:25	9.0-10.0
Back - Lumbar	Single	28-32	20-30	10:40-14:00	0.20-0:50	168.0-320.0	0.20-0:50	6.0-10.0
	Multi	8-9	20-30	3:00-4:00	1.00-2.50	240.0-450.0	0.20-0:50	6.0-10.0
	Cluster	8-9	40-90	6:00-11:00	0:10-0:75	72.0-270.0	0.05-0:10	4.0-4.5
Back - Thoracic	Single	36-40	20-30	13:20-18:00	0.20-0:50	216.0-400.0	0.20-0:50	6.0-10.0
	Multi	9-10	20-30	3:20-4:30	1.00-2.50	270.0-500.0	0.20-0:50	6.0-10.0
	Cluster	9-10	40-90	6:40-11:20	0:10-0:75	200.0-243.0	0.05-0:10	4.0-4.5
Neck	Single	18-24	20-30	8:00-9:00	0.20-0:25	108.0-120.0	0.20-0:50	6.0-10.0
	Multi	5-6	20-30	2:00-2:30	1.00-1.25	150.0-150.0	0.20-0:50	6.0-10.0
	Cluster	5-6	60-90	6:00-7:30	0:10-0:75	135.0-180.0	0.05-0:10	4.5-6.0
CANINE 50 lb: IVDD; Wounds								
IVDD	Single	32-64	20-30	16:00-21:20	0.20-0:25	240.0-256.0	0.20-0:50	6.0-10.0
	Multi	8-16	20-30	4:00-5:20	1.00-1.25	300.0-320.0	0.20-0:50	6.0-10.0
	Cluster	8-16	40-90	12:00-16:00	0:10-0:75	288.0-320.0	0.05-0:10	4.0-4.5
Superficial/Acute Wound	Single	20-60	20-40	As applicable.	0.05-0:25	As applicable.	0.04-0:20	1.6-4.0
	Multi	Treat over intact skin around entire wound periphery.	20-40	As applicable.	0.25-1.25	As applicable.	0.04-0:20	1.6-4.0
	Cluster	Treat over intact skin around entire wound periphery.	20-40	As applicable.	0.05-0:25	As applicable.	0.04-0:20	1.6-4.0
Difficult Wound Note 5 & 6	Single	20-60	20-40	As applicable.	0.05-0:25	As applicable.	0.04-0:20	1.6-4.0
	Multi	Treat over intact skin around entire wound periphery.	20-40	As applicable.	0.25-1.25	As applicable.	0.04-0:20	1.6-4.0
	Cluster	Treat over intact skin around entire wound periphery.	20-40	As applicable.	0:10-0:75	As applicable.	0.03-0:10	1.6-4.0

WALY Veterinary Dosage Recommendations Task Force								
Stationary Contact Application: Super-Pulsed 904/905 nm								
CANINE 50 lb: Osteoarthritis/Degenerative Joint Disease								
PATHOLOGY / ANATOMICAL LOCATION	PROBE TYPE / ANATOMICAL LOCATION	NUMBER OF PROBE APPLICATIONS / POINTS / SITES / Note 2	DURATION PER POINT / SITE (seconds)	TOTAL TREATMENT DURATION (minutes)	TOTAL AVERAGE POWER (Watts)	TOTAL ENERGY (Joules)	SURFACE IRRADIANCE (W/cm ²)	FLUENCE AT TARGET POINT/SITE (Joules/cm ²)
Manus/Pes	Single	3-5	20-30	1:30-1:40	0.01-0:06	3.6-7.2	0.02-0:06	1.8-2.0
	Multi	1-2	20-30	0:30-1:40	0.04-0:11	16.0-38.4	0.02-0:06	1.8-2.0
	Cluster	1-2	40-90	1:00-1:30	0:10-0:72	6.0-64.8	0.02-0:06	1.8-2.0
Carpus/Tarsus	Single	3-5	20-30	1:30-1:40	0.01-0:06	3.6-7.2	0.02-0:06	1.8-2.0
	Multi	1-2	20-30	0:30-1:40	0.04-0:11	16.0-38.4	0.02-0:06	1.8-2.0
	Cluster	1-2	40-90	1:00-1:30	0:10-0:72	6.0-64.8	0.02-0:06	1.8-2.0
Elbow	Single	8-12	20-30	4:00-4:20	0.01-0:06	14.4-36.0	0.02-0:06	2.4-2.6
	Multi	2-3	20-30	1:00-1:20	0.04-0:11	16.0-38.4	0.02-0:06	2.4-2.6
	Cluster	1-2	40-90	1:00-1:30	0:10-0:72	12.0-57.6	0.02-0:06	2.4-2.6
Shoulder	Single	8-12	20-30	4:00-4:20	0.01-0:06	14.4-36.0	0.02-0:06	2.4-2.6
	Multi	2-3	20-30	1:00-1:20	0.04-0:11	16.0-38.4	0.02-0:06	2.4-2.6
	Cluster	1-2	40-90	1:00-1:30	0:10-0:72	12.0-57.6	0.02-0:06	2.4-2.6
Stifle	Single	12-16	20-30	5:20-6:00	0.01-0:06	18.0-57.6	0.02-0:06	3.0-3.6
	Multi	3-5	20-30	1:20-1:30	0.04-0:11	18.0-72.0	0.02-0:06	3.0-3.6
	Cluster	1-2	40-90	2:00-2:30	0:10-0:72	30.0-86.4	0.02-0:06	3.0-3.6
Hip	Single	16-20	20-30	6:00-11:00	0.01-0:06	24.0-72.0	0.02-0:06	3.0-3.6
	Multi	4-5	20-30	1:20-1:30	0.04-0:11	24.0-90.0	0.02-0:06	3.0-3.6
	Cluster	1-2	40-90	2:00-2:30	0:10-0:72	30.0-86.4	0.02-0:06	3.0-3.6
Back - Lumbar	Single	28-32	20-30	10:40-14:00	0.01-0:06	42.0-153.6	0.02-0:06	3.0-4.8
	Multi	7-8	20-30	3:00-4:00	0.04-0:11	42.0-153.6	0.02-0:06	3.0-4.8
	Cluster	7-8	40-90	6:00-11:00	0:10-0:72	30.0-172.8	0.02-0:06	3.0-4.8
Back - Thoracic	Single	36-40	20-30	13:20-18:00	0.01-0:06	64.8-192.0	0.02-0:06	3.6-4.8
	Multi	8-10	20-30	3:20-4:30	0.04-0:11	64.8-192.0	0.02-0:06	3.6-4.8
	Cluster	8-10	40-90	6:40-11:20	0:10-0:72	54.0-230.4	0.02-0:06	3.6-4.8
Neck	Single	18-24	20-30	8:00-9:00	0.01-0:06	32.4-115.2	0.02-0:06	3.6-4.8
	Multi	5-6	20-30	2:00-2:30	0.04-0:11	36.0-144.0	0.02-0:06	3.6-4.8
	Cluster	5-6	60-90	6:00-7:30	0:10-0:72	36.0-172.8	0.02-0:06	3.6-4.8
CANINE 50 lb: IVDD; Wounds								
IVDD	Single	32-64	20-30	16:00-21:20	0.01-0:06	57.6-207.2	0.02-0:06	3.6-4.8
	Multi	8-14	20-30	4:00-5:20	0.04-0:11	57.6-136.0	0.02-0:06	3.6-4.8
	Cluster	8-14	40-90	10:00-14:00	0:10-0:72	54.0-230.4	0.02-0:06	3.6-4.8
Superficial/Acute Wound Note 5	Single	20-60	20-40	As applicable.	0.01-0:06	As applicable.	0.02-0:06	1.2-1.6
	Multi	Treat over intact skin around entire wound periphery.	20-40	As applicable.	0.04-0:11	As applicable.	0.02-0:06	1.2-1.6
	Cluster	Treat over intact skin around entire wound periphery.	20-40	As applicable.	0:10-0:72	As applicable.	0.02-0:06	1.2-1.6
Difficult Wounds Note 5 & 6	Single	20-60	20-40	As applicable.	0.01-0:06	As applicable.	0.02-0:06	1.8-2.4
	Multi	Treat over intact skin around entire wound periphery.	20-40	As applicable.	0.04-0:11	As applicable.	0.02-0:06	1.8-2.4
	Cluster	Treat over intact skin around entire wound periphery.	20-40	As applicable.	0:10-0:72	As applicable.	0.02-0:06	1.8-2.4

The Use of Lasers in Canine Rehab

WALT Veterinary Dosage Recommendations Task Force
Scanning Application: CW & Switched/Gated-CW

Wounds - Superficial or Acute
Non-Contact Application with Constant Motion

Area (cm2)	Dosage (J/cm2)	Power (Watts)	Time (Min:Sec)	Total Energy (Joules)	Irradiance, 25mm (W/cm2)	Irradiance, 50mm (W/cm2)
Note 1.	Note 2.	Note 3.	Note 3.		Note 4.	Note 4.
25	3	1	1:15	75	0.20	0.05
50	3	2	1:15	150	0.41	0.10
100	3	2	2:30	300	0.41	0.10
150	3	3	2:30	450	0.61	0.15
200	3	3	3:20	600	0.61	0.15
250	3	3	4:10	750	0.61	0.15
300	3	4	3:45	900	0.82	0.20

Wounds - Deep or Chronic
Non-Contact Application with Constant Motion

Area (cm2)	Dosage (J/cm2)	Power (Watts)	Time (Min:Sec)	Total Energy (Joules)	Irradiance, 25mm (W/cm2)	Irradiance, 50mm (W/cm2)
Note 1.	Note 2.	Note 3.	Note 3.		Note 4.	Note 4.
25	5	1	2:05	125	0.20	0.05
50	5	2	2:05	250	0.41	0.10
100	5	4	2:05	500	0.82	0.20
150	6	4	3:45	900	0.82	0.20
200	6	5	4:00	1200	1.02	0.26
250	6	6	4:10	1500	1.22	0.31
300	6	6	5:00	1800	1.22	0.31

WALT Veterinary Dosage Recommendations Task Force
Scanning Application: CW & Switched/Gated-CW


Feline 10 lb: Osteoarthritis/Degenerative Joint Disease
Contact Application with Constant Motion

50# Feline Pathology / Anatomical Location	Area (cm2)	Dosage (J/cm2)	Power (Watts)	Time (Min:Sec)	Total Energy (Joules)	Irradiance, 25mm (W/cm2)	Irradiance, 50mm (W/cm2)
Note 1.	Note 2.	Note 3.	Note 3.	Note 3.		Note 4.	Note 4.
Mandib/Pes	40	3	1	2:00	120	0.20	0.05
Carpus/Tarsus	50	4	2	1:45	210	0.41	0.10
Elbow	60	5	3	1:45	315	0.61	0.15
Shoulder	90	6	4	2:20	560	0.82	0.20
Stifle	90	4	3	2:00	360	0.61	0.15
Hip	90	6	4	2:20	560	0.82	0.20
Back-Lumbar	100	7	5	2:20	700	1.02	0.26
Back-Thoracic	120	7	5	2:45	825	1.02	0.26
Neck	80	7	4	2:20	560	0.82	0.20
IVDD	120	7	5	2:45	825	1.02	0.26

CANINE 50 lb: Osteoarthritis/Degenerative Joint Disease
Contact Application with Constant Motion

50# Canine Pathology / Anatomical Location	Area (cm2)	Dosage (J/cm2)	Power (Watts)	Time (Min:Sec)	Total Energy (Joules)	Irradiance, 25mm (W/cm2)	Irradiance, 50mm (W/cm2)
Note 1.	Note 2.	Note 3.	Note 3.	Note 3.		Note 4.	Note 4.
Mandib/Pes	100	5	4	2:00	480	0.82	0.20
Carpus/Tarsus	100	6	5	2:00	600	1.02	0.26
Elbow	180	6	6	3:00	1080	1.22	0.31
Shoulder	200	8	7	4:00	1680	1.43	0.36
Stifle	180	7	6	3:30	1260	1.22	0.31
Hip	220	8	8	3:20	1760	1.63	0.41
Back-Lumbar	250	8	9	3:45	2025	1.84	0.46
Back-Thoracic	275	8	9	4:00	2160	1.84	0.46
Neck	220	8	8	3:20	1760	1.63	0.41
IVDD	275	8	9	4:00	2160	1.84	0.46

LASER THERAPY





- Other crazy things you can laser
 - Urinary Tract Infections: 8 – 9 J/cm2
 - Otitis Externa: 3 – 4 J/cm2 supf; 8 – 10J/cm2 deep; 10-20J/cm2 Chronic
 - Rhinitis & Sinusitis: 8 – 10 J/cm2
 - Kidney disease: 50J/cm2 to kidneys & proximal humerus
 - Bladder: Laser L2-4 for hypogastric N & S1-3 for Pelvic & Pudendal Ns at 2 – 4J/cms2 & 20J/cm2 over caudal abdomen
 - Anal sacculitis: 4 – 8J/cms2 & Anal Abscess: 8 – 10 J/cm2
 - Peri-Anal Fistula: 12 – 14J/cm2
 - Bacterial Folliculitis: 3 – 4J/cms2 non-contact
 - Non-Inflammatory Alopecia: 3J/cm2

Goldine 2017

AND ON THAT NOTE...

- Go have some bright & shiny fun out there with your laser!
- Thanks for listening!




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Laser Therapy in Canine Rehab - References

October 2018

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